

WHAT IS CLAIMED IS:

1. An MEMS variable optical attenuator comprising:
 - a substrate having a planar surface;
 - 5 a micro-electric actuator arranged on the planar surface of the substrate;
 - a pair of optical waveguides having a receiving end and a transmitting end, respectively, and coaxially arranged on the planar surface;
- 10 an optical shutter movable to a predetermined position between the receiving end and the transmitting end of the optical waveguides, and driven to move by the micro-electro actuator; and
- 15 a surface layer formed on the optical shutter, having reflectivity less than 80% so as for incident light beams to partially transmit thereinto, and having a light extinction ratio to a thickness thereof, thereby extinguishing the partially transmitted light beams therein.
- 20 2. The MEMS variable optical attenuator as set forth in claim 1, wherein the surface layer is formed of a material selected from a group comprising Ti, TiO₂, Cr, CrO₂, W, Te and Be.

3. The MEMS variable optical attenuator as set forth in
claim 1, wherein the surface layer is formed of a double layer
comprising a first layer formed of a material selected from a
group including Ti, Cr, W, Te and Be and a second layer formed
5 of TiO_2 or CrO_2 .

4. The MEMS variable optical attenuator as set forth in
claim 1, wherein the optical shutter is a flat panel shape and
arranged to be oblique between the transmitting end and the
10 receiving end.

5. The MEMS variable optical attenuator as set forth in
claim 1, wherein the optical shutter has a first surface
perpendicular to an optical axis of the receiving end of the
15 optical waveguide and a second surface oblique relative to the
transmitting end of the optical waveguide with an inclination
angle less than 90° .

6. The MEMS variable optical attenuator as set forth in
20 claim 4, wherein the optical shutter has a half wedge shape.

7. The MEMS variable optical attenuator as set forth in
claim 1, wherein the actuator includes:
an electrode section comprising a ground electrode fixed

onto the substrate and driving electrodes;
a spring arranged on the substrate and connected to the ground electrode at one end thereof; and
a movable mass connected to the other end of the spring
5 and arranged on the substrate to be movable toward the driving electrodes.

8. The MEMS variable optical attenuator as set forth in claim 7, wherein the surface layer is formed of a material
10 selected from the group comprising Ti, Cr, W, Te and Be, and the electrodes are coated with the same material as the surface layer.

9. An MEMS variable optical attenuator comprising:
15 a substrate having a planar upper surface;
a micro-electro actuator arranged on the planar upper surface of the substrate;
optical waveguides having a receiving end and a transmitting end, respectively, and coaxially arranged on the
20 upper surface; and
an optical shutter movable to a predetermined position between the receiving end and the transmitting end of the optical waveguides,
wherein the optical shutter has a first surface

perpendicular to an optical axis of the receiving end and a second surface oblique relative to the transmitting end of the optical waveguide with an inclination degree less than 90° .

5 10. The MEMS variable optical attenuator according to claim 9, wherein the optical shutter has a half wedge shape.